3.3.1 GROUND STATION TRANSMITTER CHARACTERISTICS

3.3.1.1 EFFECTIVE RADIATED POWER (ERP)

The effective full output radiated power shall not exceed 100 Watts. It should be maintained at greater than 50 Watts ERP. (See the Commission's rules, Part 22, Paragraph 506.)

3.3.1.2 DELETED

3.3.1.3 HARMONICS AND SPURIOUS

Transmitter harmonics and spurious output shall be attenuated greater than $(43 + \text{Log}_{10}P_{mean})$ dB below the main carrier level. (See the Commission's rules, Part 22, Paragraph 106.)

3.3.1.4 FREQUENCY TOLERANCE

The departure of the transmitter frequency from the nominal channel frequency shall be less than $\pm 0.00025\%$ for all environmental conditions including ambient temperature.

3.3.1.5 TRANSMITTER SETTLING TIME

3.3.1.5.1 CHANNEL SETTLING TIME

The time from the instant of decoding a command to change channels, or key the transmitter, to the instant when the channel stabilizing element stays within 0.25 kHz of the stabilized operating frequency shall be less than 200 milliseconds. There shall be no RF output power from the transmitter during this interval.

3.3.1.5.2 RF POWER OUTPUT SETTLING TIME

The transmitter power output shall be within 3 dB of full power output within 20 milliseconds of a transmitter turn-on command, following the channel settling time.

3.3.1.6 TRANSMITTER OUTPUT SEQUENCE (CONTROL CHANNEL)

The transmitter shall be turned on and modulated with a "0" data signal in phase with the signal to follow for 40-60 milliseconds prior to the transmission of the uplink data message. The transmitter shall remain on, unmodulated for 20-40 milliseconds after the uplink data message. The transmitter shall be at full power during this output sequence. (See Figure 2, Appendix I)

3.3.1.7 TRANSMITTER POWER OFF

The carrier output in a transmitter off condition shall be less than -60 dBm. This level must be achieved within 50 milliseconds after removal of keying signal.

3.3.1.8 IDLE WORKING CHANNEL TRANSMITTER

The working channel transmitter power output shall be reduced 10 dB to 13 dB from full output under idle conditions. The carrier shall be modulated with a 941 Hz, 1633 Hz tone pair (DTMF D) at a deviation level of $\pm$3.5 kHz, $\pm$0.25 kHz. The two tones, when recovered in a standard de-emphasized receiver shall be within 1 dB of equal amplitude.

NOTE: Those base stations in service but not providing automatic direct dial capability shall use an idle tone consisting of 697 Hz, 1209 Hz tone

3.3.1.9 MODULATION CHARACTERISTICS, GROUND STATION TRANSMITTERS

The transmitter shall be FM modulated.

3.3.1.10 VOICE AND CONTROL SIGNALS

The modulator circuitry must accommodate the voice frequency spectrum of 300 to 3000 Hz. These signals are derived from network sources and the control signalling modem and may include tone and digital signals derived from acoustic coupler devices, modems, etc.

Commentary:

Remote transmitter control techniques such as tone control systems with notch filters in the audio passband may not provide satisfactory performance in the transmission of digital modulation and DTMF tones.

3.3.1.10.1 PRE-EMPHASIS

The pre-emphasis characteristic shall be nominally +6 dB per octave between 300 and 3000 Hz.

3.3.1.10.2 MODULATION LEVEL

The level of modulation of the transmitter should be as high as possible, consistent with keeping the loudest talker from producing excessive distortion. In general, average speech, as received on a companion receiver, should produce an audio output which is 6 dB below the value indicated on a VU meter for 1000 Hz non-limited modulation that provides two-thirds (2/3) of rated system deviation.

The level of the control channel signalling modulation shall be set such that the 2200 Hz tone produces at least ±4.5 kHz deviation but not exceeding ±5 kHz.

3.3.1.10.3 DEVIATION LIMITER

For network audio inputs applied to the ground station transmitter the audio signal processing stages must limit the instantaneous frequency deviation to ±5 kHz. (See the commission's rules, Part 22, Paragraph 508(d).)

3.3.1.10.4 POST DEVIATION LIMITER FILTER

The post deviation limiter filter shall have a stop band characteristic as described in the Commission's rules, Part 22, Paragraph 508(g).

3.3.1.10.5 GROUND STATION TRANSMITTER DISTORTION, VOICE SIGNALS

A 1000 Hz test tone modulating the transmitter at a deviation of ±3.0 kHz shall result in less than 5.0% distortion.

3.3.1.11 DIGITAL SIGNALS (DATA PORT PROVISION)

Digital (data) signal inputs, band limited between 300 and 3000 Hz, may be used to FM modulate the ground transmitter. Pre-emphasis is not used. See Paragraph 4.1 for control message modulation characteristics. Direct input from a networked data source or buffer is regarded also as a digital input signal and treated according to this paragraph and subparagraphs. See commentary under paragraph 3.3.1.10

3.3.1.11.1 MODULATION LEVEL

The level of modulation for data shall be a deviation of ±4.0 kHz, ±0.25 kHz. Under no circumstances may instantaneous peak deviation exceed ±5.0 kHz.

3.3.1.11.2 GROUND STATION TRANSMITTER DISTORTION, DIGITAL (DATA) SIGNALS

The 1200 Hz test tone modulating the transmitter at a deviation of ±4.0 kHz shall result in less than 5.0% distortion.

3.3.1.11.3 DELETED

3.3.1.12 GROUND STATION TRANSMITTER HUM AND NOISE

The FM hum and noise level shall be at least 40 dB below standard modulation when tested with a standard receiver utilizing a C-message filter.

3.3.1.13 GROUND STATION TRANSMITTER GROUP DELAY

The differential group delay from any audio input to modulated transmitter output shall be less than 100 microseconds when measured at 600 Hz and 2400 Hz.

3.3.2 GROUND STATION RECEIVER

3.3.2.1 SENSITIVITY

The RF sensitivity of the receiver with the transmitter keyed shall be equal to or better than -110 dBm for 12 dB SINAD when using an EIA standard test signal.

3.3.2.2 SELECTIVITY

Adjacent channel selectivity (±25 kHz) shall be better than 65 dB when measured using the EIA two tone test method. The passband of the receiver filter should be equal to or greater than ±6.5 kHz at the 6 dB points.

3.3.2.3 SPURIOUS RESPONSE

Image and spurious responses shall be better than 70 dB down.

3.3.2.4 DEMODULATION CHARACTERISTICS

3.3.2.4.1 VOICE SIGNALS AND CONTROL SIGNAL OUTPUT

The demodulated output shall provide for voice signals with a bandwidth of 300 to 3000 Hz and shall be de-emphasized. See commentary under paragraph 3.3.1.10.

3.3.2.4.1.1 DE-EMPHASIS

The de-emphasis characteristic must have a nominal -6 dB per octave response between 300 and 3000 Hz.

3.3.2.4.1.2 DISTORTION

Audio output at full level applied to the telephone network shall have less than 5% harmonic distortion when tested with a standard test signal.

3.3.2.4.1.3 HUM AND NOISE

Audio output applied to the telephone network shall have hum and noise 40 dB below a 1000 Hz tone with $\pm$3.0 kHz deviation when measured using C-message filtering with the RF input set at a level of 1000 microvolts.

3.3.2.4.2 DIGITAL SIGNALS (DATA PORT PROVISION)

A separate port shall be provided from the receiver IF demodulator for digital (data) signal use. The frequency response of this port is nominally flat from 300 to 3000 Hz. See commentary under paragraph 3.3.1.10.

3.3.2.4.2.1 DISTORTION

Audio output to a data signal user shall have less than 5% harmonic distortion when tested with a 1000 microvolt signal modulated with a 1200 Hz tone, at $\pm$4.0 kHz deviation.

3.3.2.4.2.2 DELETED

3.3.2.4.2.3 SIGNALLING DEGRADATION

A net frequency drift of ±2.5 kHz in the receiver equipment and test generator shall cause no more than a 3 dB increase in the RF input above a reference level to maintain the same bit error rate (BER) that is achieved by the RF reference level signal that produces 12 dB SINAD (standard test conditions) on frequency (zero network frequency error).

3.3.2.4.2.4 HUM AND NOISE

Audio output to a data signal user shall have hum and noise at least 30 dB down (flat audio), when tested with a 1000 microvolt RF input and referenced to standard signalling modulation.

3.3.2.4.3 DATA ERROR RATE

The signalling data demodulator (modem) shall have a bit error rate of better than 7×10^{-3} at an RF input level that produces 12 dB SINAD on the voice audio connection. This test shall be performed using a series of alternating 1's and 0's.

3.3.2.5 GROUP DELAY DISTORTION

Differential group delay when measured from RF input to any output shall be less than 100 microseconds over the frequency range of 600 Hz to 2400 Hz.

4.0 CONTROL SIGNALLING METHOD

Control of the system is accomplished by transmitting short serial digital messages between air-to-ground and vice versa in the control channel.

4.1 CONTROL SIGNAL STANDARD

The control signal standard used in the control channel is a derivative of the Bell 202 standard. The mark, logic level 1, is transmitted and received at 1200 Hz. The space, logic level 0, is transmitted and received at 2200 Hz. The mark/space transition shall be generated by a means providing phase continuity.

4.1.1 MARK/SPACE FREQUENCY TOLERANCE

The mark shall be transmitted as a 1200 Hz tone, $\pm$0.1% tone. The space tone frequency shall be 2200 Hz, $\pm$0.1%.

4.1.2 CONTROL SIGNAL DATA RATE

The data shall be transmitted at 1200 bits per second, $\pm$0.01%.

4.1.3 CONTROL SIGNAL DATA CLOCK SYNCHRONIZATION

The receiving data clock may be synchronized from the data message preamble. The preamble is a series of alternating logical 1's and 0's, clocked at the data rate and in phase with the data to follow.

4.2 CONTROL SIGNALLING FORMATS

This section describes the digital signals transmitted in the control channel between the aircraft equipment and the ground station. Section 4.2.1 describes the digital signals sent by the ground station to the aircraft equipment. Section 4.2.2 describes the digital signals sent by the aircraft equipment to the ground station.

4.2.1 DIGITAL SIGNALS SENT BY THE GROUND STATION (UPLINK)

The digital signal sent from the ground station is a message in the form shown in Figure 1.

80	7	4	4	1	27	4	40	8	8	8	8	16	8
PRE	DS	T	ST	CL	ID	CHNL	AMIN	SER	MN	SP1	SP2	BCS	EOT

t=0

FIGURE 1. UPLINK MESSAGE FORMAT

The total message is 223 bits in length. The data (words) are the 112 bits that follow the data sync (DS) and precede the block check sequence (BCS). The preamble (PRE) is 80 bits of alternating logic 1's and 0's. The data sync (DS) is a seven bit Barker code as follows:

1 1 1 0 0 1 0

t=0

A breakdown of the message and its words is given in Table 2.0.

CODE	VALUE MSB	VALUE LSB	REMARKS
PRE	10	10	PREAMBLE
DS	1110010		Data Sync
T	0001		Type; message type field; value shown is for all AGRAS signalling; other values reserved but undefined.
ST	XXXX		STatus ||||-------1 = Busy; working channel is or will be busy |||--------1 = Queue; GS has one or more ARUs in queue ||---------1 = Queue full; two stations in queue |----------1 = Service denied
CL	0/1		CLass mark; ground station; 1 = Class I (provides queueing) 0 = Class II (cannot provide queueing)

TABLE 2. UPLINK MESSAGE BREAKDOWN

TABLE 2. (CONTINUED)

CODE	VALUE MSB	VALUE LSB	REMARKS
ID	XX---X		IDentification; Ground station latitude and longitude expressed to 0.1 degree as follows:

```
|----------Latitude----------|        N = 0
|                            |        S = 1
   N/S                  X  X .X
    |                   |  |  |
   (1)(1)(1)(4)(4)(4)(4)(4)(4)        (#bits, BCD)
       |  |  |  |  |
     E/W Y  X  X .X
      |                 |
      |--Longitude---|                E = 0
                                       W = 1
```

CHNL	XXXX	CHannel; Ground station working channel number 1 through 12 expressed in 4 bit binary.
AMIN	XX---X	Aircraft Mobile Identification Number; ten BCD digits.
SER	0 - 255	SERvices; '00000000' is telephone only; other services assigned a bit location to define eight services in any combination.
MN	XXXXXXXX	Message Number; 8 bit binary number where the four most significant bits are the root message type and the four least significant bits are normally zero except as follows (See Paragraph 4.2.1.1 for a complete list of message types):
	10010000	CRRD, Network Data Service #1
	10010001	CRRD, Network Data Service #2
	0100XXX0	UCS, where -XXX- identifies a service and the position of a bit in the Service field as follows:
	-000-	Network Data Service #1; LSB in Service field
	-001-	Network Data Service #2
	-010-	Service #1
	-011-	Service #2

TABLE 2. UPLINK MESSAGE BREAKDOWN

TABLE 2. (CONTINUED)

CODE	VALUE MSB LSB	REMARKS
	-100-	Service #3
	-101-	Service #4
	-110	Service #5
SP1	00000000	SPare bit field #1; reserved for the extension of 'services' codes.
SP2	00000000	SPare bit field #2
BCS	XX---X	Block Check Sequence; 16 bit remainder of the division of the function derived from considering the binary digits of the data to be the coefficients of a polynomial, of arbitrary value X, by the CCITT[1] polynomial of the form: $P(x) = x^{16} + x^{12} + x^{5} + 1$.
EOT	10000100	End Of Transmission; ASCII EOT character with even parity.

TABLE 2. UPLINK MESSAGE BREAKDOWN

4.2.1.1 LIST OF WORDS SENT BY GROUND STATION (UPLINK)

Code names given to the messages sent by the ground station along with the full word descriptors are listed in Table 3.

[1] See January 1961 issue of the proceedings of the IRE; paper entitled "Cyclic Codes for Error Detection."

CODE	MEANING	MESSAGE NUMBER
BCST	BroadCaST Information	00000000
CQR	Clear Queue Response	10000000
CRRD	Call Request Response, Data	1001000X
CRRQV	Call Request Response, Queue, Voice	10110000
CRRV	Call Request Response, Voice	11000000
FFR	Flight Following Response	11010000
GACK	Ground ACKnowledge	01010000
UCN	Up Call, Normal	00010000
UCOQV	Up Call Out of Queue, Voice	00110000
UCRR	Up Call Reply Response	00100000
UCS	Up Call, Services	0100XXX0

TABLE 3. UPLINK MESSAGE LIST

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4.2.2 DIGITAL SIGNALS SENT BY THE AIRCRAFT STATION (DOWNLINK)

The digital signal sent from the aircraft station is a message in the form shown in Figure 2.

80	7	4	4	1	27	4	40	32	8	8	8	8	72	16	8
PRE	DS	T	ST	CL	ID	CHNL	AMIN	AVER	SER	MN	SP1	SP2	TEL#	BCS	EOT

t=0

FIGURE 2. DOWNLINK MESSAGE FORMAT

The total message is 327 bits in length. The data (words) are the 216 bits that follow the data sync (DS) and precede the block check sequence (BCS). The data sync (DS) is the same as used in the uplink message format. A breakdown of the data is the same as shown for the uplink message with the exception of the added words, TEL# and AVER.

The telephone number (TEL#), can be up to eighteen digits in four bit BCD. Telephone numbers shorter than 18 digits are followed by an "F Hex" digit. The AMIN verification digits (AVER), can be up to eight digits in four bit BCD. Verification numbers shorter than 8 digits are followed by an "F Hex" digit.

The least significant bit in the status (ST) bits is used to indicate the credit card number (AMIN) source. If the AMIN and AVER in the downlink message are numbers stored in the ARU then the bit is "zero". If the AMIN and AVER are numbers entered from the handset (credit card) then the bit is set to "one". The three unused status bits arereserved spares.

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4.2.2.1 LIST OF WORDS SENT BY AIRCRAFT STATION (DOWNLINK)

Code names given to the messages sent by the aircraft station along with the full word descriptors are listed in Table 4..

4.3 DETAILED MESSAGE BREAKDOWN

A detailed breakdown of both the ground station (uplink) and aircraft station (downlink) control messages is given in the tables in Appendix A.

4.3.1 MESSAGE ASSEMBLY AND ORDER OF TRANSMISSION

Data and the BCS is transmitted in the order, most significant word to least significant word and most significant bit to least significant bit.

CODE	MEANING	MESSAGE NUMBER
AACK	Airborne ACKnowledge	0101 0000
CQI	Clear Queue Interrogation	0000 0000
DCOD	Directed Call Originate, Data	0001 0000
DCOV	Directed Call Originate, Voice	0010 0000
FFI	Flight Following Interrogation	0011 0000
ICOV	Indirect Call Originate, Voice	0100 0000
QAR	Queue Accept Response	1000 0000
SR	Services Response	1001 0000
UCR	UpCall Reply	1010 0000

TABLE 4. DOWNLINK MESSAGE LIST

4.4 CONTROL MESSAGE FLOW CHARTS

Flow charts in Appendix B depict the sequence of events necessary to signal between the ground station and the aircraft station and vice versa to connect calls in the working channel.

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5.0 SYSTEM PROCEDURES AND PARAMETERS

5.1 AIRBORNE TRANSMITTER CONTROL AND SIGNALLING

The airborne transmitter shall be used for signalling in the control channel and carrying voice and data signals in the working channels. Control signalling is done in half duplex (automatic PTT) manner. The working channels are operated full duplex only.

5.2 WORKING CHANNEL CONTROL TONE REPLY

Upon receipt of a valid uplink message, of the UCN, or UCOQV type (See Table 3) the ARU transmitter shall reply with a UCR message. The ARU transmitter shall then remain off until an "off-hook" condition is recognized. An "off-hook" condition causes the transmitter to again be keyed on and modulated with a 300 millisecond 770 Hz, 1622 Hz control tone pair (DTMF B) to signal a "connect" and be followed by connection to the microphone circuit. (Note: The receiver audio is connected at this time and not before.) The transmitter shall remain keyed for the duration of the communication.

Upon receipt of a valid uplink message of the UCS type and the Service Data Field is a binary representation of 2^0 or 2^1 (See Table 3), the transmitter shall be switched to the proper working channel, and after frequency settling time then keyed on, and send a 300 millisecond 770 Hz, 1633 Hz control tone pair (DTMF B) to signal a "connect". Connection to the data interface is made as appropriate. The transmitter will remain keyed for the duration of the data exchange.

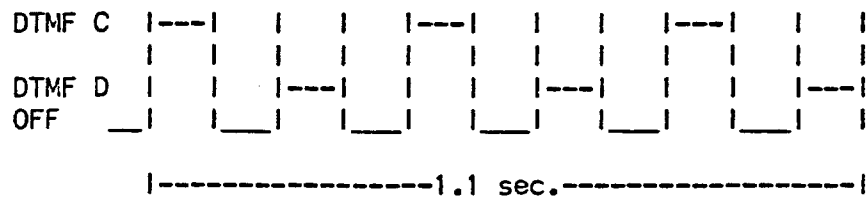
Upon receipt of a CRRD or CRRV type message, the transmitter shall be switched to the proper working channel, and after frequency settling time then keyed on, and send a 300 millisecond, 770 Hz, 1633 Hz control tone pair (DTMF B) to signal a "connect". Connections to the audio circuits or data interface are made as appropriate. The transmitter shall remain keyed for the duration of the communication.

Commentary:

The control tone replies are of ample length in time to allow for airborne transmitter power-up delay time, ground station squelch break delay time and ground station to terminal remote signalling delay time.

5.3 CALL TERMINATE

Upon completion of a direct dialed call and with a return to "on-hook" or termination of data message the transmitter shall send a "terminate" signal as shown in Figure 3 prior to returning to the idle condition. The call terminate tone pair sequence may not be generated under any other condition. See Appendix C for DTMF tone pair frequency list.



T_{on} = T_{off} = 100 milliseconds

FIGURE 3. DISCONNECT TONE PAIR SEQUENCE

5.4 CONTROL SIGNALLING INITIATION

Either the ground station or the ARU can initiate a signalling sequence. The first message of a sequence may be sent immediately if no activity is sensed in the receive channel. If there is a message in the receive channel when a command to transmit is generated then the start of that transmission is delayed until 2.5 seconds, ±50 milliseconds after the message ends, i.e., the channel goes silent.

5.5 RETRANSMISSION OF MESSAGE

When a message origination requiring an acknowledgement is sent and that acknowledgement is not received for whatever reason, the message shall be repeated, if necessary, up to three repeats. The originating end will be responsible for any repeats on a round. The time delay between the command to transmit of the repeated message and the end of the previous transmission (E.O.T.) of that message shall be randomly delayed such that the delay is equally probable, to a resolution of at least 200 milliseconds, within the range of from 0.8 to 3.0 seconds.

5.6 REPEATED SIGNALLING FAILURE

With a failure to achieve an acknowledgement to a message sent repeatedly, the equipment either airborne or ground, as appropriate, shall return a reorder tone[2] to the caller.

[2]See CCITT Document Number AP (111-84)

5.7 CONTROL SIGNALLING TURNAROUND TIME

Turnaround time is defined as the time from the end of a received data message to the start of the preamble of the reply data message. Turnaround time shall be 500 milliseconds, ±20 milliseconds, with the following exception. In the case of an ICOV message the ground station shall respond with a BCST message with the turnaround time randomly selected and equally probable in the range of from 500 milliseconds to 4.0 seconds.

5.7.1 PROCESSOR/DECODER RECOVERY TIME

Processor/Decoder recovery time is defined as that time from the end of a message transmitted or from the end of a nuisance message received to the start of the next message received that can be successfully decoded. Recovery time shall be less than 50 milliseconds.

5.8 WORKING CHANNEL TRANSMITTER BUSY TONE

After sending a message type UCN or UCOQV (See Table 3.), and while waiting for the "off hook" acknowledge tone (See Paragraph 5.2), the ground station shall transmit a busy tone (See Appendix D).

5.9 UPCALL SIGNALING PROCEDURE

The ground station, in signaling an upcall, shall set a timer for a period of 60 seconds after receiving an AACK message or immediately after sending the last repeated UCRR or UCOQV message. If upon expiration of the timer the called party has not returned a connect tone the ground station shall disconnect and revert to the idle status if the queue is empty. The caller, in the case of a normal upcall will be given a reorder tone in the process of disconnecting.

5.9 UPCALL SIGNALING PROCEDURE (cont.)

After transmitting an AACK the ARU shall continue to monitor the control channel, until an "off hook" condition is detected.

5.10 SIGNAL DROP-OUT TIMER

If during a call connection, the ground station detects a loss of the aircraft transmitter, a 30 second timer, shall be set. If, at the expiration of this timer, the transmitter signal level has not recovered, the ground station shall disconnect by reverting to the idle condition and returning a reorder tone (See Appendix D) as required.

5.11 BROADCAST MESSAGE TIMING

The broadcast message (BCST) may be sent from each ground station for each channel on the average of once every 90 seconds. The period shall be jittered at least ± 1 second to avoid synchronism with other ground station broadcasts. Immediately after the ground station status changes, for any reason, other than the result of an up link message which carries the current status information, the ground station shall broadcast the updated status once and reset the period timer for the next routine broadcast.

5.12 REPEATED MESSAGE TYPES

The messages listed in Table 5. are of the type that normally require a response. They may be repeated according to the rules set out in Paragraph 5.5. Other messages are sent only once and not repeated.

5.12 REPEATED MESSAGE TYPES (cont.)

UPLINK	DOWNLINK
UCN	ICOV
UCOQV	DCOV
UCRR	DCOD
UCS	FFI
	CQI
	QAR

TABLE 5. REPEATED MESSAGE LIST

5.13 QUEUEING SIGNALLING PROCEDURES

An ARU may queue (camp-on) using the signalling procedure shown in Appendix B. If the ARU is used to place another call before the UCOQD or UCOQV message is received, then it shall initiate an Aircraft Clear Queue message sequence (See Appendix B), before signalling for the next call. A failure of the called ARU to respond to an UCOQV or UCOQD message after repeated tries by the ground station shall cause the ground station to clear out the Queue Request and proceed to the next aircraft ARU in queue or go idle as appropriate.

Up to two calls may be held in queue. With the queue so loaded the ground station shall ignore further requests for service.

5.14 CALL TRAFFIC MANAGEMENT

A call request from an ARU arranged on a busy working channel will normally be queued on that channel and served when the channel becomes idle. However where working channels are managed in groups, the call may be connected to another working channel that is idle. The ARU shall extinguish the busy light should one exist, upon receipt of the CRRV message indicating an idle status.

5.15 MANUAL TRANSMITTER LOCK-OUT

The ARU transmitter keying circuit shall be rendered inoperative on any channel where the received ground station signal does not break squelch or meet a criteria as established by a signal level determining circuit. Signal drop out after a call is in progress should not cause the ARU transmitter to be unkeyed until after a time out period or "On-Hook".

5.16 MESSAGE REPLY-TIME WINDOW

When either the ground station or the ARU transmits a message that requires a reply on the control channel, the receiver or processor shall listen for the reply only in the time interval that begins after the turnaround time and ends after the turnaround time plus the length of the reply message expected.

5.17 TRANSMITTER PROTECTIVE TIMER (AIR AND GROUND)

The length of all control channel transmissions shall be limited by a timer. Fail safe timer circuitry shall limit a transmission to less than one (1) second.

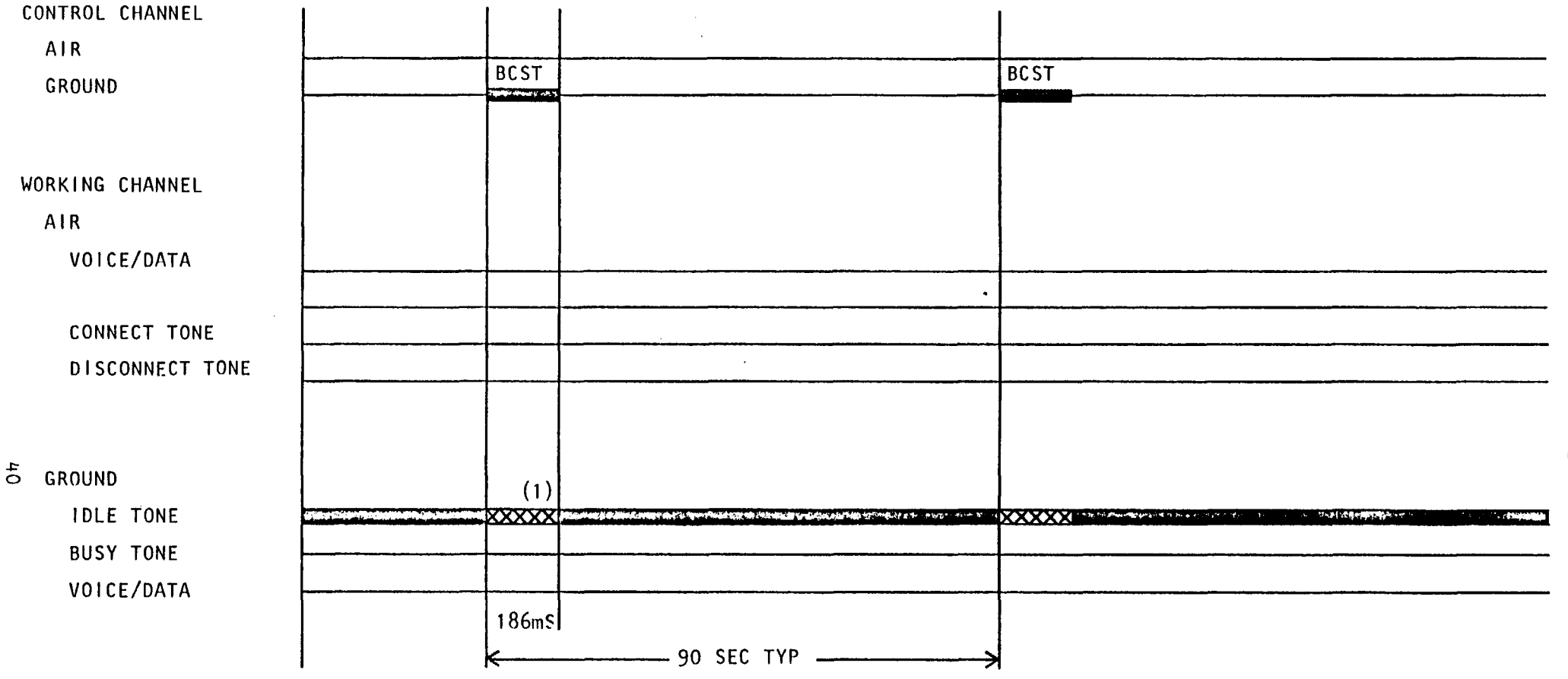
BITS:	87	4	4	1	27	4	40	8	8	8	8	16	8
CODE	PRE/ DS	T	STATUS	CL	ID	CHNL	AMIN	SERVICES	MN	SP1	SP2	BCS	EOT
BCST	-	0001	000 0---- 111	0/1	A/N	N	0	0 - 255	00000000	00000000	00000000	N	10000100
CQR	-	0001	0 00-1 1	1	A/N	N	N	0 - 255	10000000	00000000	00000000	N	10000100
CRRD	-	0001	0000	1	A/N	N	N	0 - 255	1001000X	00000000	00000000	N	10000100
CRRQV	-	0001	00 --11 11	1	A/N	N	N	0 - 255	10110000	00000000	00000000	N	10000100
CRRV	-	0001	0001	0/1	A/N	N	N	0 - 255	11000000	00000000	00000000	N	10000100
FFR	-	0001	000 0---- 111	1	A/N	N	N	0 - 255	11010000	00000000	00000000	N	10000100
GACK	-	0001	00 0--1 11	0/1	A/N	N	N	0 - 255	01010000	00000000	00000000	N	10000100
UCN	-	0001	0001	0/1	A/N	N	N	0 - 255	00010000	00000000	00000000	N	10000100
UCOQV	-	0001	000 ---1 111	1	A/N	N	N	0 - 255	00110000	00000000	00000000	N	10000100
UCRR	-	0001	0001	0/1	A/N	N	N	0 - 255	00100000	00000000	00000000	N	10000100
UCS	-	0001	000 0---- 111	1	A/N	N	N	0 - 255	0100XXX0	00000000	00000000	N	10000100

TABLE 1A. UPLINK MESSAGES

BITS:	87	4	4	1	27	4	40	32	8	8	8	8	72	16	8
CODE	PRE/ DS	T	STATUS	CL	ID	CHNL	AMIN	AVER	SERVICES	MN	SP1	SP2	TEL#	BCS	EOT
AACK	-	0001	0 000-1	*	A/N	N	N	N	00000000	01010000	00000000	00000000	*	N	100001
CQI	-	0001	0 000-1	*	A/N	N	N	N	00000000	00000000	00000000	00000000	N	N	100001
DCOD	-	0001	0 000-1	*	A/N	N	N	N	2^N(N=0/1)	00010000	00000000	00000000	0	N	100001
DCOV	-	0001	0 000-1	*	A/N	N	N	N	00000000	00100000	00000000	00000000	N	N	100001
FFI	-	0001	0 000-1	*	A/N	N	N	N	1 - 255	00110000	00000000	00000000	0	N	100001
ICOV	-	0001	0 000-1	*	0	N	N	N	00000000	01000000	00000000	00000000	N	N	100001
QAR	-	0001	0 000-1	*	A/N	N	N	N	00000000	10000000	00000000	00000000	N	N	100001
SR	-	0001	0 000-1	*	A/N	N	N	N	2^N(N=0-7)	10010000	00000000	00000000	0	N	100001
UCR	-	0001	0000	*	A/N	N	N	N	00000000	10100000	00000000	00000000	*	N	100001

TABLE 2A. DOWNLINK MESSAGES

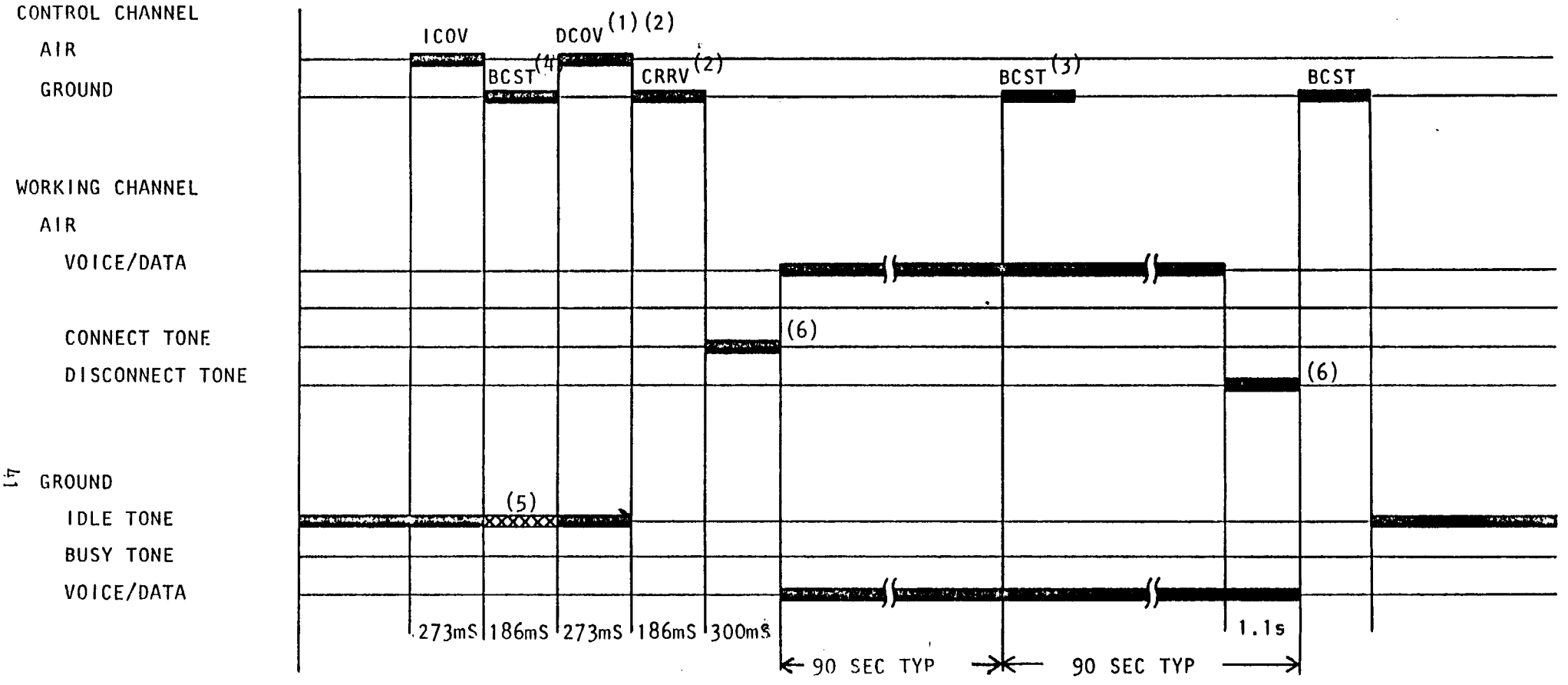
*DON'T CARE



(1) INTERRUPTION, CLASS II STATION

NOTES:
a) DO NOT SCALE TIME BASE
b) DATA BURST SIGNALLING AND TONE TIME IS MESSAGE TIME ONLY.
c) TURN-AROUND TIME IS NOT SHOWN

FIGURE 1B GROUND STATION IDLE



(1) START AT DCOV FOR DIRECTED CALL
(2) FOR DATA NETWORK CALL USE: START AT DCOD IN PLACE OF DCOV, CRRD IN PLACE OF CRRV
(3) CLASS I GROUND STATION ONLY
(4) BCST RESPONSE TO ICOV IS RANDOMLY DELAYED (SEE PARA. 5.7)
(5) INTERRUPTION, CLASS II STATION
(6) DISREGARD FOR NETWORKED DATA

NOTES: a) DO NOT SCALE TIME BASE
b) DATA BURST AND SIGNALLING TONE TIME IS MESSAGE TIME ONLY.
c) TURN-AROUND TIME IS NOT SHOWN

REV. H

FIGURE 2B AIRCRAFT CALL ORIGINATE